



Original communication

Fatal firearm injuries in autopsy cases at central Bangkok, Thailand: A 10-year retrospective study



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ABSTRACT

Even though there have been previously published reports on firearm injuries in various countries, the incidence and pattern of death from firearm injuries in Thailand have not been studied before. In present study, 149 fatal firearm injuries from 2002 to 2011 were reviewed. At total of 7126 autopsies, fatal firearm injuries comprised of 2.09% ($n = 149$) of total autopsies cases. Among those victims, 136 were male (91.3%), 13 (8.7%) were female. The youngest age of victim was 10 years and the oldest was 79 years. Mean age of the victims was 33.79 years and median age was 30 years. Outdoor incident was the most common scene of crime. Night time incident (18:00 PM–05:59 AM) was higher than day time one. Most of the cases occurred in week ends ($n = 52$). Homicide (77.2%) was the most frequent manner of death. Head/face and chest were the most common sites of entrance. The autopsy report also study on entrance wound, range and types of projectiles. Blood alcohol concentration was examined in 122 cases and 38 victims showed positive results, 11 cases revealed using of illegal substances in blood and urine analysis. This study also included the association between manner of death and other factors. Age group, time of incidence, place of incidence, number of entrance wound and range showed statistically significant association with manner of death.

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1. Introduction

A number of people all over the world die, unfortunately, every day due to injuries caused by firearm. Apparently, mass production of advance firearm and its availability in worldwide have an effect on increasing death and injuries caused by such weapon.¹ The magnitude of deaths due to guns varies greatly in different parts of the world, mainly because the weapons are easy accessibly in the context of social and cultural background and political conflicts. In developing countries, illegal firearms and locally made firearms or country guns are available without licensing. These guns are commonly used in criminal cases.²

According to UNODC 2004, the number of reported firearm homicides in Thailand has increased every year. A study regarding to various methods of homicide in Ramathibodi Hospital from January 2003 to December 2007 showed that homicide by firearm was the most common method in both male and female victims.³ According to Gunpolicy.org website, Thailand ranks the highest rate of civilian gun possession among regional countries.⁴ The estimated number of gun possessed by civilian both licit and illicit in Thailand was 10,000,000⁵. The estimated rate of civilian gun ownership in Thailand was 15.6 firearms per 100 people. Thailand ranks 11th private gun ownership comparing with 178 countries around the world.⁵

Even though there have been previously published reports on firearm injuries in various countries, the incidence and pattern of death from firearm injuries in Thailand (Specifically in Bangkok) have not been studied before. Identification of demographic, socio-economic, behavioral, and environmental risk factors will be considered in order to establish effective interventions for preventing any kind of injury and disease.⁶ Evaluation and analysis of those factors that are influencing the fatal firearm injury can assist the

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government, policy makers, law enforcement body and health care personnel to establish effective policies and strategies to prevent such morbidity and mortality.⁹ The objectives of this study were to find the incidence, pattern, autopsy findings and associated risk factors of fatal firearm injuries in Bangkok, Thailand. Simultaneously, to compare the results of the study with other studies in particular countries.

2. Materials and methods

Retrospective study design is applied in this study. Data were reviewed from autopsy reports of fatal firearm cases from January 2002 to December 2011. Those data was obtained through Autopsy Service, Department of Pathology, Faculty of Medicine Ramathibodi Hospital, Mahidol University. All cases were investigated by police and performed complete forensic autopsy by forensic doctor. All firearm death cases confirmed by police investigation and complete forensic autopsy were included in this study. Explosive deaths and death from riot control were excluded from this study. A pro-forma was created for recording data regarding to the demographic and the socio-economic, circumstance of incidence, the autopsy findings, the information of perpetrator and the toxicology results.

Data were analyzed by descriptive statistics and chi-square test using SPSS for Windows Version 18.0. A statistical significance will be considered at p -value <0.05.

3. Results

The results were divided into five parts: the demographic factors, circumstance of incidence, autopsy findings and toxicology results, information of perpetrator, relationship between manner of death and other factors.

3.1. Demographic factors

During 10-year period from January 2002 to December 2011, total of 7126 cases of autopsies had performed at autopsy unit in Ramathibodi Hospital. Gunshot fatality comprised of 2.1% (149 cases) of total autopsy cases. Out of 149 fatal firearm cases, 136 (91.3%) victims were male and 13 (8.7%) victims were female. The male to female ratio was 10.5:1. Average cases per year was 13.6 ($n = 136$) for male and 1.3 ($n = 13$) for female (Fig. 1).

Mean age of the gunshot wound victims was 33.79 years old (SD = 14.08) and median age was 30 years. The youngest age of victim was 10 years and the oldest one was 79 years old. It can be categorized the continuous age into 7 groups. The most frequent age groups were the age group (21–30 years) and (31–40 years) comprising 38.3% and 19.5% respectively (Table 1).

The majority of fatal gunshot wound (GSW) cases were Thai nationality ($n = 140$, 94.0%). The rest 9 cases (6.0%) were other nationality, 8 Myanmar and 1 American (Table 1).

3.2. Circumstance of incidence

The study distributed cases according to seasons, day and time of incidence, place of incidence and police responsible area

Table 1

Distribution of fatal firearm injuries according to age groups and race.

Demographic factors		Total number of cases	Percent
Age groups	≤20	20	13.4
	21–30	57	38.3
	31–40	29	19.5
	41–50	24	16.1
	51–60	8	5.4
	≥61	8	5.4
	Unknown	3	1.9
Nationality	Thai	140	94.0
	Non-Thai ^a	9	6.0

^a Myanmar and American.

(Table 2). The incidences occurred highest in rainy season. No significant association between manner of death and season in our study (summer and winter were combined to dry season) (Table 5).

As for day of incidence, most of the GSW cases occurred in weekend at 34.8% ($n = 52$), during the period of time at 0:00–6:00 AM and 18:00–23:59 PM. The incident of the GSW was higher at night time. Table 2 showed frequencies and percentages of fatal the GSW cases according to police responsible area. Phayathai police area was the highest rate ($n = 55$) of the fatal GSW.

As for place of incidence, more than half of the fatal GSW cases occurred outdoor and social activity places, 33.6% and 31.5% respectively. For suicide, private home was the most frequent scene of incidence. The least frequent place of incidence was in automobile of 6 cases (4.0%). There were 12 cases in our study that of the place of incidence could not be identified. In this study, scene of incidence is found to be associated with manner of death ($\chi^2 = 48.4562$, p -value = 0.000) (Table 5).

3.3. Autopsy findings

Majority of the fatal GSW cases were homicidal victims, included 106 male and 9 female. It was 77.2% of the total fatal GSW cases occurred during 10 years period. The second common manner of death was suicide (21.5%), consisting of 29 male and 3 female. There was only one accidental fatal GSW case that occurred when two children playing together with a gun. No either hunting accident or accident by oneself was found in the study. There was only one female victim of whom manner of death could not be exactly determined (Table 3).

The most common cause of death was brain injury at 45.0% ($n = 67$). Followed by hemorrhagic shock at 28.2% ($n = 42$). There were 31 cases (20.8%) died by other vital organ injury. There were 3 cases died due to spinal cord injury, 3 cases of pneumonia, and 1 case of multi-organ failure. Moreover, 1 case of septicemia was found as complications following gunshot injury. There was one case of neurogenic shock that the death one was hit at the buttock without injuring at any other internal organ and main vessels.

Single GSW was found in 28 suicidal cases (87.5%) and 43 non-suicidal cases (36.8%), totally 71 cases (47.7%). Majority of the multiple GSW cases were non-suicidal cases ($n = 74$). Four cases of multiple GSW were identified as suicide. There is significant

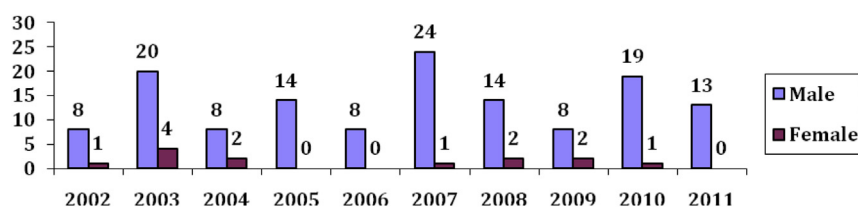


Fig. 1. Annual number of fatal firearm injury cases according to gender.

Table 2
Distribution of fatal firearm injury cases according to circumstance of incidence.

Circumstances		Total number of cases	Percent
Season	Summer	30	20.1
	Rainy	73	49.0
	Winter	46	30.9
Day of incidence	Monday	16	10.7
	Tuesday	19	12.8
	Wednesday	24	16.1
	Thursday	21	14.1
	Friday	17	11.4
	Saturday	26	17.4
	Sunday	26	17.4
Time of incidence (hour)	0:00–5:59	47	31.5
	6:00–11:5	31	20.8
	12:00–17:59	26	17.4
	18:00–23:59	40	26.8
	Unknown	5	3.4
Responsible police area	Phaya Thai	55	36.9
	Din Daeng	23	15.4
	Makkasan	22	14.8
	HuaiKwang	24	16.1
	ChanaSongkram	4	2.7
	Dusit	8	5.4
	Samsen	6	4.0
	Others	7	4.7
Place of incidence	Private home/apartment	34	22.8
	Social activity places	47	31.5
	Outdoor	50	33.6
	In automobile	6	4.0
	Unknown	12	8.1

association between manner of death and number of entrance wound ($\chi^2 = 25.942$, $p\text{-value} = 0.000$) (Table 4).

Twenty cases of suicide and 2 cases of non-suicide (homicide) were shot in contact range. Near contact range were found in 9 cases of suicide and 3 cases of non-suicide. There was no case of suicide in close and distant ranges at all. Total of 104 cases of non-suicidal cases were shot from close and distant range. In 11 cases, range could not be definitely interpreted. Range showed significant association with manner of death ($\chi^2 = 112.306$, $p\text{-value} = 0.000$) (Table 4).

Head and face region was the most frequent site of entrance wound. It was found in 78 cases. Followed by chest and back region ($n = 77$). The least frequent site of entrance wound was the neck region that 11 cases of non-suicide were shot there. There was no case of suicide that shot to the neck, abdomen and pelvic or lower extremities at all (Table 5).

Projectiles could be recovered from 91 cases (61.1%). From 58 cases (38.9%), projectiles could not be recovered. Bullet could be recovered and identified in 79 cases and pellets from 12 cases. There was no case of suicide died of pellet injury in our study. Bullets could be recovered from 7 cases of suicide. Among homicidal cases from those projectiles could be recovered, bullets were found in 72 cases and pellets in 12 cases. The above mentioned autopsy findings were shown in (Table 4).

Brain was the most common injured internal organ in our study found in total 70 cases, contributing of 28 cases of suicide and 48

Table 3
Distribution of manner of death according to gender.

Manner of death	Gender		Total number of cases (%)
	Male	Female	
Accident	1	0	1(0.7)
Suicide	29	3	32(21.5)
Homicide	106	9	115(77.2)
Undetermined	0	1	1(0.7)

Table 4
Distribution of autopsy findings according to manner of death.

		Manner of death			Chi-square	p-Value
		Suicide	Non-suicide	Total number of cases		
Number of entrance wounds	Single	28	43	71	25.9421	0.000
	Multiple	4	74	78		
Range	Contact/near-contact	29	5	34	112.3065	0.000
	close/distant	0	104	104		
Type of projectile	Bullet	7	72	79	1.1519	0.283
	Pellet	0	12	12		

cases of non-suicide. Lungs were the second most frequent injured internal organ followed by heart found in 68 and 35 cases respectively. Among abdominal organs, the liver was injured most frequently followed by intestines. The least common organ was the spleen. Among suicide GSW cases, brain was outstandingly common than any other organ. There were only 3 cases that injured lungs among all suicide. One case of suicide shot in chest region injured heart and lungs. Another case of suicide was got injuries in lungs, stomach and liver when discharging in chest region. Among non-suicide, especially homicide, lungs were the leading organ that got injured accounting for 65 cases. Brain was the second most common organ found in 42 cases followed by the heart in 34 cases (Table 6).

3.4. Toxicological results

In this study, we had focused on blood alcohol level and illegal abused substance such as amphetamine, methamphetamine etc. Blood alcohol concentration was tested in 122 cases. For the rest 27 cases, no information could be traced. Out of 122 cases, 84 cases showed negative results and 13 cases within legal limit (<50 mg % in Thailand). 10 cases were found to be blood alcohol level between 50 and 149 mg% and 15 cases showed the results of blood alcohol level that exceeds 150 mg%. The highest blood alcohol concentration level among suicidal case was 425.82 mg%.

Results of blood and urine analysis for drug and substances could be traced in 68 cases. The rest 81 cases showed no information regarding drugs and substances. Only 11 cases showed the positive results for illegal substances (Table 7).

3.5. Information of perpetrator

Out of 117 cases of non-suicidal GSW cases, 13 cases were armed force personnel (police) on their duties. Victims of those

Table 5
Distribution of site of entrance wound and manner of death.

Site of entrance wound		Suicide	Non-suicide	Chi-square	p-Value
Head/face	Present	29	49	23.934	0.000
	Absent	3	68		
Neck	Present	0	11	3.2484	0.071
	Absent	32	106		
Chest/back	Present	3	74	29.2038	0.000
	Absent	29	43		
Abdomen/pelvic	Present	0	27	9.019	0.003
	Absent	32	90		
Upper extremities	Present	1	33	8.974	0.003
	Absent	31	84		
Lower extremities	Present	0	14	4.226	0.040
	Absent	32	104		

Table 6
Distribution of injured internal organs.

Injured internal organs	Manner of death		
	Suicide	Non-suicide	Total
Brain	28	42	70
Lungs	3	65	68
Heart	1	34	35
Liver	1	22	23
Stomach	1	8	9
Intestines	0	16	16
Kidneys	0	9	9
Spleen	0	3	3
Major blood vessels	0	20	20
Spinal cord	0	11	11
Others*	0	12	12

Others* = diaphragm, trachea, esophagus, mesentery.

perpetrators were drug dealers. The rest homicide victims had been killed by other perpetrators but the information regarding perpetrators could be traced only 17 cases from the hospital data.

3.6. The association between manner of death in fatal GSW and other factors

In our study, there was only one case of accident and one case of undetermined. Therefore, we combined homicide, accident and undetermined in one category as non-suicide. The association between manner of death of fatal GSW in two categories (suicide and non-suicide) and other factors such as age group, gender, nationality, place of incidence, time of incidence, season of incidence, number of entrance wound, site of entrance wound, range, types of projectile, blood alcohol level and illegal substance use were studied. As shown in Table 8, it was found that the age group, place of incidence and time of incidence were associated with the manner of death by firearm injury.

4. Discussion

Firearm fatality is the world global health problem destroying a number of lives and properties. In order to prevent firearm fatality, it is necessary to identify what the risk factors are. It is different from countries to countries. In our study, total of 149 cases of fatal firearm injury cases were recruited from autopsy reports between January 2002 and December 2011. This accounts for 2.1 percent of total autopsy cases. Male victims accounted for 91.3% of total firearm fatality cases. The gender ratio was 10.5:1, reflecting male dominance throughout the 10 year period. This pattern is similar to other studies from around the world.^{7–20} Male gender is a well-known risk factor of violence. By nature, male is more aggressive than female and is prone to such violent injuries. Male usually go outside for working and they might face stressful conditions. They

Table 7
Toxicological results.

Toxicological results		Number of cases	Percent
Blood alcohol	Negative	84	56.4
	<50	13	8.7
	50–150	10	6.7
	>150	15	10.1
	No information	27	18.1
Blood and urine analysis for illegal substances	Positive	11	7.3
	Negative	57	38.3
	No information	81	54.4

Illegal substances = amphetamine, methamphetamine, ephedrine, pseudoephedrine and cocaine.

Table 8
Association between manner of death and other factors.

Factors		Manner of death			Chi-square	p-Value
		Suicide	Non-suicide	Total number of cases (%)		
Gender	Male	29	107	136 (91.3)	0.0216	0.883
	Female	3	10	13 (8.7)		
Age group	<30	10	61	71 (47.7)	4.3945	0.036*
	≥30	22	56	78 (52.3)		
Place of incidence	Private home	22	12	34 (22.8)	48.4562	0.000*
	Others	8	96	104 (69.8)		
Time of incidence	06:00–17:59	21	36	57 (38.3)	11.6671	0.001*
	18:00–05:59	11	76	87 (58.4)		
Day of incidence	Week days	23	74	97 (65.1)	0.823	0.364
	Week ends	9	43	53 (34.9)		
Season	Dry	12	64	76 (51.0)	2.975	0.085
	Rainy	20	53	73 (49.0)		
BAC ^a	Positive	6	32	38 (25.5)	0.5265	0.468
	Negative	18	66	84 (56.4)		
Substances abuse	Positive	1	10	11 (7.4)	0.4859	0.486
	Negative	10	47	57 (38.3)		
Total				149		

*Statistical significant (p -value < 0.05).

^a BAC = blood alcohol concentration.

usually involve in risk situations for firearm fatality like organized crime, gang fight and drug smuggling. These factors, therefore, ensure that male gender has high risk in firearm injuries. On the other hand, female is usually not interested in firearm possession and is, then, less prone to risk of suicide by firearms.

In consistent with other studies that young age is the one of the risk factor in fatal firearm injury, the age of 21–30 years old and 31–40 years old are the most common age group in fatal firearm injuries.^{7–11,16–21} Younger age is more aggressive compare to older age. That behavior can lead the youth to brawl and fight. In addition, the young age groups usually enjoy going to night entertainments such as bars, pubs and clubs. They, therefore, encounter conflicts and fight in those places. They are also working ages that face stressful situations in their daily activity. Moreover, they may also associate with gangs and drug dealing.

Human behavior could be affected by seasonal variations. Bad weather might lead people to miserable and violent behavior.⁵ In our study, there was an outstanding rate of incident in the rainy season higher than in the summer and the winter. This may be due to the fact that the rainy season is the longest season according to Thailand climate. Rainy season starts from May and ends up in October while winter is from November to February and summer consists of March and April. This might be one of the reasons of high rate of gunshot cases in rainy season. In similar with other reports, Saturday and Sunday are the common days for fatal firearm injuries.^{3,22}

As reported by previous studies, most of the crimes occur during night time.^{3,19,22} Evening and night time show higher rate of firearm injury and this may be due to the fact that most of violence crimes occur at these periods of time. In our study, the most common period for fatal firearm injuries was 00:00 AM–6:00 AM. To clarify, it is the after-party time that people get drunk and violent risk. In the evening and at night, people are exhaust due to work, therefore, they may lose temper easily compare to in the morning and at day. They can be provoked easily during these times and violence may be followed.

Phayathai police area showed distinctly highest rate of incidence of fatal firearm injury in this study. This is comply with previous study relate to homicidal cases in Bangkok.³ It is a commercial district of Bangkok where heterogenic by tourists and migrant workers. Drug dealing is common in this district targeting

tourists. HuaiKwang district is connected to Phayathai district which is the second most common police area for fatal firearm injury. The famous Royal City Avenue and other night life venues full of pubs and clubs are located in there. It is the largest night entertainment area of Bangkok.

Similar result with the study by Fedakar et al., outdoor is the most common place of incidence for gunshot fatality followed by social activity places.⁷ In this study, majority of fatal gunshot cases were outdoor and social activities places homicide. This study showed different result regarding homicide from the study in Italy and England where both homicide and suicide cases happened commonly in private home.^{10,23} But for suicidal gunshot cases, majority of suicide occurred in private home or apartment.^{10,24} However, Amiri reported different result regarding place of incidence for suicidal cases. That almost all of the suicidal cases committed in police stations or garrison.⁹ Only one case of suicide and five cases of homicide were happened in automobile.

There were 72%, 21.5%, 1.3% and 1.3% of fatal firearm injury cases were homicide, suicide, accident and undetermined respectively. Results of manner of death in this study were similar to the study in Turkey,^{7,8} Iran,⁹ Southern Italy¹¹ and Egypt.¹⁹ However, the studies from Brescia (Northern Italy),¹⁰ Sweden^{12,24} and Denmark²⁵ showed different pattern of firearm injury that suicide was the dominant manner of death followed by homicide and accident. The studies in Yorkshire and Humberside showed that homicide was the most common manner of death but the percentages of homicide and suicide were not significantly different as in the current study.²³ In all study, accident accounts for minor ratio. A cheap and unlicensed gun from black market is one of the reasons of high incidence of homicidal gunshot fatalities in developing countries. In developed industrialized countries, access to illegal guns is not as easy as in developing countries. In Thailand, people usually legally possess a gun under licensed after thorough verification. However, illegal guns can be easily bought from black markets without verifying process. According to Gunpolicy.org website, the number of registered gun in Thailand had been reported 6,200,000. It is 11th in world ranking of number of privately owned firearm. Reports from small arm survey indicated that gun smuggling is high in Thailand. It is known as the biggest black market in the Southeast Asia region.⁵ As reported by many studies, possession of gun is the major risk factor of firearm fatality.⁶ Suicidal rate by firearm in this study showed similar results with the studies in Turkey and Iran.^{7–9} In contrast, the studies in Bari, Delhi and Suez Canal area of Egypt revealed lesser percent of suicidal firearm fatality.^{11,19}

Brain and other vital organ injuries and hemorrhagic shock were the most common cause of death in this study. Deaths by complications, for example, septicemia, pneumonia and organ failure, comprised only a few numbers of cases. This finding showed similar results from other study.¹⁰

In homicidal GSW, the multiple entrance wounds were common. This result differs from other studies in which the single entrance wound was common in homicide. However, for the suicide, the results are similar.^{8,23} All but 4 of suicide showed single entrance wound. There were reports in literatures about suicides with multiple entrance wounds.^{10,11,26,27} Manner of death and number of entrance wound showed significant relation in this study.

In consistent with other studies, there was no case of suicide shot by close/distant range. All cases of suicide were shot by contact/near contact range. Only five cases of homicide were discharged from contact/near contact range. The rest were shot from distant range.⁸ In our study, range of gunshot was associated with manner of death.

Majority site of the entrance wounds were head/face region ($n = 78$) and chest/back region ($n = 77$). Most of the suicidal GSW cases chose the head as site of entrance. In our study, 28 cases of

suicide shot in head region. Only 3 cases of suicide shot in chest region. There was one case of suicide that shot upper extremity. Twenty-six cases of non-suicidal GSW cases were shot in abdomen and pelvic region. Entrance wound in extremities were usually found in association with fatal wounds in other region. These findings comply with other reports.^{7–12,15,17,23} In the study by Jean Bahabeak et al., extremities were the most injured region ($n = 133$). However, these finding represented all cases of fatal and non-fatal firearm injuries. For fatal GSW cases, their study also showed similar result that head and chest regions were the most common.¹⁸ The neck region was the least frequent region which was different from the studies in Turkey⁷ and Italy.¹⁰ In their studies, extremities were the least frequent region for fatal firearm injuries.

In accordance with site of entrance wounds, brain was the most frequent injured internal organ accounting in 28 cases of suicide and 48 cases of homicide cases. The second leading injured internal organs were lungs followed by the heart as the third. Head and chest are preferred target compared to other regions for an assailant who using a firearm. Head and chest are also classical sites of entrance for one who commits suicide. These are the reasons why brain, lungs and heart are the most injured internal organs. Lungs were the most vulnerable internal organs among homicides. In abdominal organs, liver and intestine are the most common injured organs. The larger area that occupied in abdomen by these organs might be the reason for vulnerability and this finding agrees with study from Delhi.²⁸

Results of recovered projectiles reflect the type of firearm that commonly used. The results from this study showed dominance of rifled firearm as well as in Delhi study.²⁸ In contracts with other studies, there is no case of suicide that committed by shotgun in our study.^{24,26,29} Pellet injury discharged by shotgun could be found only in homicidal victims. According to lack of data about the exact type of firearm, it can be estimate based on type of projectiles. It could not identify whether these guns are licit or illicit. If it is possible to trace the exact type of firearm and its legitimacy, it will be valuable information to implement prevention and control strategy.

Regarding to the blood alcohol test, only 25.5% (38 cases) revealed positive results which was lower than the study in Brescia (44.8%). In Thailand, the upper limit of blood alcohol level for driving is 50 mg% and the same limitation is also applied in other incidences. Among these cases, 13 cases showed the results within legal limit and 25 cases (16.8%) result above the legal limit. 18.1% ($n = 27$) of the cases showed missing results regarding blood alcohol test. Out of 38 positive cases, 6 cases were suicidal victims and the rest 32 cases were homicidal victims. This finding is in line with study in Turkey.⁷ In the study from Ireland, 39% of suicidal victims consumed alcohol prior to the incident. The alcohol consumption rate in such study is higher than in the current study.²⁹ There is no association between blood alcohol result and manner of death in our study. Only 11 cases showed positive results for illegal substances in blood and urine sample. In our study, amphetamine and methamphetamine were common drugs and only one case that appeared cocaine in toxicological reports.

Among homicidal victims, 13 cases were killed by armed force personals during their duties. Those criminals were illegal drug sellers. Substance abuse and trafficking is one of the important problems for this type of crime. Civilian assaults were found in 17 cases of homicide. From our current records in the hospital, information concerning about perpetrator could not, unfortunately, be identified in 87 cases.

5. Conclusion

From this study, young adult aged man was a vulnerable victim of firearm injuries mostly in homicide. The most frequent sites of

entrance wound were head and chest. Brain, lungs and heart were the most vulnerable internal organs. Shotgun is rarely used in this region. Age groups, place of incidence, time of incidence were associated with manner of death. From autopsy findings, manner of death was associated with number of entrance wound, range and site of entrance wound. This study was based on information at hospital in central Bangkok and it is required to do further study from other centers.

Ethical approval

This project has been reviewed and approved by the Committee on Human Rights Related to Research Involving Human Subjects, Faculty of Medicine Ramathibodi Hospital, Mahidol University, based on the Declaration of Helsinki (MURA2013/216).

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Conflict of interest

The authors declared no conflict of interest.

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References

- Humayun M, Khan D, Fasee-uz-Zaman, Khan J, Khan O, Parveen Z, et al. Analysis of homicidal deaths in district DI Khan: an autopsy study. *J Ayub Med Coll Abbottabad* 2009;**21**(1):155–7.
- Saleh SM. A preliminary study of firearm injury and death in Qena Governorate, Egypt in year 2008. *Ain Shams J Forensic Med Clin Toxicol* 2010;**14**:99–112.
- Pattarapanitchai N, Tiensuwan M, Riengrojpitak S. A retrospective study on homicidal autopsy Casesat ramathibodi hospital in bangkok Thailand. *Chiang Mai J Sci* 2010;**37**(2):282–92.
- Gunpolicy.org [Internet]. *Armed violence in Thailand: conflict prevention, development, peace and security*. [cited 2013 Oct 21]. Available from: <http://www.gunpolicy.org>.
- Gunpolicy.org [Internet]. *Guns in Thailand: facts, figures and firearm law*. [cited 2013 Oct 29]. Available from: <http://www.gunpolicy.org/firearms/region/thailand>.
- Powell EC, Sheehan KM, Christoffel KK. Firearm violence among youth: public health strategies for prevention. *Ann Emerg Med* 1996;**28**(2):204–12.
- Fedakar R, Gündoğmuş UN, Türkmen N. Firearm-related deaths in two industrial cities of Turkey and their province. *Leg Med Tokyo* 2007;**9**(1):14–21.
- Azmak D, Altun G, Bilgi S, Yilmaz A. Firearm fatalities in Edirne, 1984–1997. *Forensic Sci Int* 1998;**95**(3):231–9.
- Amiri A, Sanaei-Zadeh H, TowfighiZavarei H, RezvaniArdestani F, Savoji N. Firearm fatalities. A preliminary study report from Iran. *J Clin Forensic Med* 2003;**10**(3):159–63.
- Verzeletti A, Astorri P, De Ferrari F. Firearm-related deaths in Brescia (Northern Italy) between 1994 and 2006: a retrospective study. *J Forensic Leg Med* 2009;**16**(6):325–31.
- Solarino B, Nicoletti EM, Di Vella G. Fatal firearm wounds: a retrospective study in Bari (Italy) between 1988 and 2003. *Forensic Sci Int* 2007;**168**(2–3):95–101.
- Ornehult L, Eriksson A. Fatal firearm accidents in Sweden. *Forensic Sci Int* 1987;**34**(4):257–66.
- Cummings P, LeMier M, Keck DB. Trends in firearm-related injuries in Washington State, 1989–1995. *Ann Emerg Med* 1998;**32**(1):37–43.
- Porteous MJ, Edwards SA, Groom AF. Inner city gunshot wounds. *Injury* 1997;**28**(5–6):385–7.
- Davies M, Kerins M, Glucksman E. Inner-city gunshot wounds—10 years on. *Injury* 2011;**42**(5):488–91.
- Coben JH, Steiner CA. Hospitalization for firearm-related injuries in the United States, 1997. *Am J Prev Med* 2003;**24**(1):1–8.
- Potwary AJ. Study of pattern of injuries in homicidal firearm injury cases. *JIAFM* 2005;**27**(2):92–5.
- Bahebeck J, Atangana R, Mboudou E, Nonga BN, Sosso M, Malonga E. Incidence, case-fatality rate and clinical pattern of firearm injuries in two cities where arm owning is forbidden. *Injury* 2005;**36**(6):714–7.
- Hagras AM, Kharoshah MAA. Medico-legal evaluation of firearm injuries during the period from 2005 to 2010 in the Suez Canal Area, Egypt: a retrospective study. *Egypt J Forensic Sci* 2012;**2**(1):1–10.
- World Health Organization [Internet]. *Small arms and global health 2001* [cited 2014 April 4] available from http://whqlibdoc.who.int/hq/2001/WHO_NMH_VIP_01_1.pdf.
- Cherry D, Annett JL, Mercy JA, Kresnow M, Pollock DA. Trends in nonfatal and fatal firearm-related injury rates in the United States, 1985–1995. *Ann Emerg Med* 1998;**32**(1):51–9.
- Mohanty MK, Kumar TS, Mohanram A, Palimar V. Victims of homicidal deaths – an analysis of variables. *J Clin Forensic Med* 2005;**12**(6):302–4.
- Chapman J, Milroy CM. Firearm deaths in Yorkshire and Humberside. *Forensic Sci Int* 1992;**57**(2):181–91.
- Druid H. Site of entrance wound and direction of bullet path in firearm fatalities as indicators of homicide versus suicide. *Forensic Sci Int* 1997;**88**(2):147–62.
- Hardt-Madsen M, Simonsen J. Firearms fatalities in Denmark 1970–1979. *Forensic Sci Int* 1983;**23**(2–3):93–8.
- Balci Y, Canogullari G, Ulupinar E. Characterization of the gunshot suicides. *J Forensic Leg Med* 2007;**14**(4):203–8.
- Hejna P, Safr M, Zátoková L. The ability to act—multiple suicidal gunshot wounds. *J Forensic Leg Med* 2012;**19**(1):1–6.
- Kohli A, Aggarwal NK. Firearm fatalities in Delhi, India. *Leg Med Tokyo* 2006;**8**(5):264–8.
- Armour A. A study of gunshot suicides in northern Ireland from 1989 to 1993. *Sci Justice* 1996;**36**(1):21–5.